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EXAMINER	
MUTSCHLER, BRIAN L	
ART UNIT	**PAPER NUMBER**
1753	9

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Please find below and/or attached an Office communication concerning this application or proceeding.

MJ

Office Action Summary	Application No. 09/975,974	Applicant(s) TAYLOR ET AL.
	Examiner Brian L. Mutschler	Art Unit 1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Comments

1. The objection to minor informalities in claims 1-7 has been overcome by Applicant's amendment.

2. The rejection of claim 30 under 35 U.S.C. §112, 2nd paragraph, has been overcome by Applicant's amendment.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-27, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. (U.S. Pat. No. 6,071,398) in view of Barstad et al. (EP 1 054 080 A2).

Regarding claim 1, Martin et al. disclose a method for depositing a uniform layer of copper on the interior surface of through-holes of a printed circuit board having "high aspect ratios" (col. 4, lines 3-6). The method comprises the steps of providing an electrically conductive substrate having through-holes with high aspect ratios and immersing the substrate and a copper anode in an acidic copper plating bath (col. 4, lines 7-15). A current is passed through the electrodes, wherein a forward, cathodic current followed by a reverse, anodic current is passed to plate the copper on the

interior of the holes (col. 4, lines 16-49). The cathodic pulses inherently have a charge transfer ratio with respect to the anodic pulses greater than one since the process is a plating process. The cathodic pulses have a duration ranging from 1 to 50 milliseconds, and the anodic pulses have a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 2-4, 6 and 7, the cathodic pulse has a duration ranging from 1 to 50 milliseconds (col. 4, lines 23-34).

Regarding claim 5, the anodic pulse has a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 8-11, based upon the pulse durations taught by Martin et al., the pulse train has a frequency in a range from about 18.5 Hz to 909 Hz.

Regarding claims 12-15, based upon the pulse durations taught by Martin et al., the cathodic pulses have a duty cycle of 20% to 99.8%.

Regarding claims 16-19, based upon the pulse durations taught by Martin et al., the anodic pulses have a duty cycle of 0.2% to 80%.

Regarding claim 27, the plating bath contains copper sulfate, sulfuric acid, chloride ions, a polyoxyalkylene compound carrier, and a sulfur-containing additive that would function as a brightener (col. 4, lines 7-15). The carrier is a surfactant that acts as a suppressor. The bath is devoid of a leveler.

Regarding claim 30, Martin et al. teach the use of a bath comprising 9.6 to 48 g/L $CuSO_4$, a molar ratio of sulfuric acid to copper sulfate of about 6:1 to 47:1, a chloride ion

concentration of 60 ppm, and about 15 mL/L of a carrier comprising a surface active compound such as a polyoxyalkylene compound (col. 4, lines 7-15).

Regarding claim 31, the diameter of the hole is 28 mils (~711 microns) (col. 6, lines 1-5).

Although Martin et al. disclose that the method is used for "electrodepositing copper onto printed circuit boards with high aspect ratios, where aspect ratio is board thickness divided by hole diameter," Martin et al. do not disclose the range of aspect ratios for which the method may be applied, as recited in claim 1 and in claims 20-26. The method of Martin et al. further differs from the instant invention because Martin et al. do not disclose the use of polyethylene glycol, as recited in claim 30.

Regarding claims 1 and 20-26, Barstad et al. disclose a method and plating solution for plating microvias, wherein "microvias with...aspect ratios of 5:1, 6:1, 7:1, 10:1 or greater, and even up to 15:1 or greater can be effectively plated...using plating solutions of the invention" (col. 10, lines 44-53). The plating bath does not require the use of levelers although their use is preferred (col. 3, lines 19-20).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the method of Martin et al. to plate cavities or through-holes having an aspect ratio of greater than 20:1 because Martin et al. disclose that the method is used for "high aspect ratios" and Barstad et al. teach that similar methods and plating baths can be used to plate through-holes with aspect ratios of 15:1 or greater. One skilled in the art would have reasonably expected success using this

method for through-holes having aspect ratios greater than 20:1 because Barstad et al. suggested that the method can be used for plating through-holes of 15:1 or greater.

Regarding claim 30, Barstad et al. teach that the suppressor agent can comprise polyoxyalkylene amines, polyethylene glycols and polyoxyalkylene glycols (col. 8, par. [0039]). The carrier agent is used in concentrations of 1 to 10,000 ppm based on the weight of the bath (col. 9, par. [0041]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the carrier agent in the method of Martin et al. to use polyethylene glycol in place of polyoxyalkylene compounds because Barstad et al. teach that polyoxyalkylene compounds and polyethylene glycol are equivalent in their use as carrier (surfactant) compounds.

5. Claims 1-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. (U.S. Pat. No. 6,071,398) in view of Anthony (U.S. Pat. No. 4,396,467).

Regarding claim 1, Martin et al. disclose a method for depositing a uniform layer of copper on the interior surface of through-holes of a printed circuit board having "high aspect ratios" (col. 4, lines 3-6). The method comprises the steps of providing an electrically conductive substrate having through-holes with high aspect ratios and immersing the substrate and a copper anode in an acidic copper plating bath (col. 4, lines 7-15). A current is passed through the electrodes, wherein a forward, cathodic current followed by a reverse, anodic current is passed to plate the copper on the

interior of the holes (col. 4, lines 16-49). The cathodic pulses inherently have a charge transfer ratio with respect to the anodic pulses greater than one since the process is a plating process. The cathodic pulses have a duration ranging from 1 to 50 milliseconds, and the anodic pulses have a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 2-4, 6 and 7, the cathodic pulse has a duration ranging from 1 to 50 milliseconds (col. 4, lines 23-34).

Regarding claim 5, the anodic pulse has a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 8-11, based upon the pulse durations taught by Martin et al., the pulse train has a frequency in a range from about 18.5 Hz to 909 Hz.

Regarding claims 12-15, based upon the pulse durations taught by Martin et al., the cathodic pulses have a duty cycle of 20% to 99.8%.

Regarding claims 16-19, based upon the pulse durations taught by Martin et al., the anodic pulses have a duty cycle of 0.2% to 80%.

Regarding claim 27, the plating bath contains copper sulfate, sulfuric acid, chloride ions, a polyoxyalkylene carrier, and a sulfur-containing additive that would function as a brightener (col. 4, lines 7-15). The carrier is a surfactant that acts as a suppressor. The bath is devoid of a leveler.

Although Martin et al. disclose that the method is used for "electrodepositing copper onto printed circuit boards with high aspect ratios, where aspect ratio is board

thickness divided by hole diameter," Martin et al. do not disclose the range of aspect ratios for which the method may be applied, as recited in claim 1 and in claims 20-26.

Anthony discloses a method for plating copper in through-holes using a pulse train of forward and reverse pulses, wherein the through-holes have a diameter "typically equal to or less than about 4 mils...[and a] thickness of the body which typically ranges from about 6 to 100 mils," which relates to an aspect ratio of up to 25:1 (col. 3, lines 54-61). The plating bath uses copper sulfate, sulfuric acid, and a brightener comprising thiourea and molasses (col. 8, lines 15-21).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the method of Martin et al. to plate cavities or through-holes having an aspect ratio of greater than 20:1 because Martin et al. disclose that the method is used for "high aspect ratios" and Anthony teaches that similar methods and plating baths can be used to plate through-holes with aspect ratios up to 25:1.

6. Claims 1-20 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin et al. (U.S. Pat. No. 6,491,806) in view of Martin et al. (U.S. Pat. No. 6,071,398).

Regarding claim 1, Dubin et al. disclose a method for plating recesses in a conductive substrate comprising immersing the substrate in a plating bath and passing a modulated reversing electric current through the substrate (col. 5, lines 36-47; col. 7, line 59 to col. 8 line 13). The recess has an aspect ratio of up to 10:1 or higher (col. 6,

lines 36-37). The cycle time of the pulsing lies in a preferred range of about 1 ms to 30 sec, a frequency of about 2 Hz to 1000 Hz (col. 8, lines 1-5). Since the method is a plating method, a counter electrode would inherently be present and the cathodic pulses would have a greater charge transfer ratio than that of the anodic pulses.

Regarding claims 8-11, Dubin et al. disclose a preferred pulse train frequency of 2 Hz to 1000 Hz (col. 8, lines 1-5).

Regarding claim 20, Dubin et al. disclose the use of recesses having aspect ratios of 10:1 or greater (col. 6, lines 36-37).

Regarding claims 27-29, Dubin et al. disclose the plating bath containing copper, sulfuric acid, chloride ions, and at least one additive selected from a group comprising suppressing agents, such as polyethylene glycol (col. 2, lines 31-38; col. 4, lines 35-37).

The method of Dubin et al. differs from the instant invention because Dubin et al. does not disclose the duration of the cathodic and anodic pulses and their respective duty cycles, as recited in claims 1-7 and 12-19.

Regarding claim 1, Martin et al. disclose a method for depositing a uniform layer of copper on the interior surface of through-holes of a printed circuit board having "high aspect ratios" (col. 4, lines 3-6). The method comprises the steps of providing an electrically conductive substrate having through-holes with high aspect ratios and immersing the substrate and a copper anode in an acidic copper plating bath (col. 4, lines 7-15). A current is passed through the electrodes, wherein a forward, cathodic current followed by a reverse, anodic current is passed to plate the copper on the interior of the holes (col. 4, lines 16-49). The cathodic pulses inherently have a charge

transfer ratio with respect to the anodic pulses greater than one since the process is a plating process. The cathodic pulses have a duration ranging from 1 to 50 milliseconds, and the anodic pulses have a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 2-4, 6 and 7, the cathodic pulse has a duration ranging from 1 to 50 milliseconds (col. 4, lines 23-34).

Regarding claim 5, the anodic pulse has a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 12-15, based upon the pulse durations taught by Martin et al., the cathodic pulses have a duty cycle of 20% to 99.8%.

Regarding claims 16-19, based upon the pulse durations taught by Martin et al., the anodic pulses have a duty cycle of 0.2% to 80%.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the pulse durations and duty cycles in the method of Dubin et al. to use the pulse durations and duty cycles taught by Martin et al. because the pulse duration and duty cycles are variables that one skilled in the art would select based upon the desired properties of the plated substrate as Martin et al. teach, "power is supplied for as long as is necessary to produce the desired deposits" (col. 4, lines 33-34).

7. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. (U.S. Pat. No. 6,071,398) in view of either Barstad et al. (EP 1 054

080 A2) or Anthony (U.S. Pat. No. 4,396,467), as applied above to claims 1-27, and further in view of Chen (U.S. Pat. No. 6,197,181).

Martin et al., Barstad et al. and Anthony describe a method teaching the limitations recited in claims 1-27 of the instant application, as explained above in sections 5 and 6.

The method described by Martin et al., Barstad et al. and Anthony differs from the instant invention because they do not teach the use of a plating bath devoid of brighteners, as recited in claim 28, or a plating bath devoid of brighteners and levelers, as recited in claim 29.

Chen discloses a method for plating copper in cavities using a plating bath comprising sulfuric acid, copper, chloride ions and organic additives, wherein "the organic additives may include levelers, brighteners, wetting agents and ductility enhancers" (col. 7, lines 1-24). Chen also disclose, "the organic additives are not absolutely necessary to the plating reaction" (col. 7, lines 10-11).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method taught by Martin et al., Barstad et al. and Anthony to use a plating bath without levelers or brighteners because Chen teaches that such additives are not necessary to the plating reaction. Deleting the brighteners and levelers from the plating bath would reduce the cost of plating the workpieces.

Double Patenting

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

9. Claims 1-27 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-23 of U.S. Patent No. 6,309,528 in view of Martin et al. (U.S. Pat. No. 6,071,398) and in view of either Barstad et al. (EP 1 054 080 A2) or Anthony (U.S. Pat. No. 4,396,467).

US '528 claims a method for plaiting recesses in an electrically conductive substrate by immersing the substrate and a counter electrode in a bath and passing a current between the electrodes (claim 1). A modulated reversing current is passed through the electrodes comprising a cathodic pulse having a duty cycle of greater than about 50% and an anodic duty cycle of less than 50% (claim 1). The frequency of the pulse train ranges from 10 to 5000 Hz (claim 1). The claims are silent with regard to the use of levelers and brighteners.

The method disclosed in claims 1-23 of US '528 differs from the instant invention because US '528 does not claim the aspect ratio, as recited in claims 1 and 20-26, or the duration of the pulse lengths, as recited in claims 1 and 2-7.

Regarding claim 1, Martin et al. disclose a method for depositing a uniform layer of copper on the interior surface of through-holes of a printed circuit board having "high aspect ratios" (col. 4, lines 3-6). The method comprises the steps of providing an electrically conductive substrate having through-holes with high aspect ratios and immersing the substrate and a copper anode in an acidic copper plating bath (col. 4, lines 7-15). A current is passed through the electrodes, wherein a forward, cathodic current followed by a reverse, anodic current is passed to plate the copper on the interior of the holes (col. 4, lines 16-49). The cathodic pulses inherently have a charge transfer ratio with respect to the anodic pulses greater than one since the process is a plating process. The cathodic pulses have a duration ranging from 1 to 50 milliseconds, and the anodic pulses have a duration ranging from 0.1 to 4 milliseconds (col. 4, lines 23-34).

Regarding claims 12-15, based upon the pulse durations taught by Martin et al., the cathodic pulses have a duty cycle of 20% to 99.8%.

Regarding claims 16-19, based upon the pulse durations taught by Martin et al., the anodic pulses have a duty cycle of 0.2% to 80%.

Regarding claim 27, the plating bath contains copper sulfate, sulfuric acid, chloride ions, a polyoxyalkylene carrier, and a sulfur-containing additive that would

function as a brightener (col. 4, lines 7-15). The carrier is a surfactant that acts as a suppressor. The bath is devoid of a leveler.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of US '528 to use the pulse durations taught by Martin et al. because the pulse duration is a variable that one skilled in the art would select based upon the desired properties of the plated substrate, and Martin et al. disclose, "power is supplied for as long as is necessary to produce the desired deposits" (col. 4, lines 33-34).

Regarding claims 1 and 20-26, Barstad et al. disclose a method and plating solution for plating microvias, wherein "microvias with...aspect ratios of 5:1, 6:1, 7:1, 10:1 or greater, and even up to 15:1 or greater can be effectively plated...using plating solutions of the invention" (col. 10, lines 44-53). The plating bath does not require the use of levelers although their use is preferred (col. 3, lines 19-20). Anthony discloses a method for plating copper in through-holes using a pulse train of forward and reverse pulses, wherein the through-holes have a diameter "typically equal to or less than about 4 mils...[and a] thickness of the body which typically ranges from about 6 to 100 mils," which relates to an aspect ratio of up to 25:1 (col. 3, lines 54-61). The plating bath uses copper sulfate, sulfuric acid, and a brightener comprising thiourea and molasses (col. 8, lines 15-21).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the method of US '528 to plate cavities or through-

holes having an aspect ratio of greater than 20:1 because Barstad et al. and Anthony teach that similar methods and plating baths can be used to plate through-holes with aspect ratios of 15:1 or greater, and with aspect ratios up to 25:1.

10. Claims 1-29 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-61 of copending Application No. 10/132,399 in view of either Barstad et al. (EP 1 054 080 A2) or Anthony (U.S. Pat. No. 4,396,467).

The copending application claims a method for depositing a continuous layer of metal in recesses on an electrically conductive substrate immersed with a counter electrode in a plating bath (claim 1). A modulated reversing electric current is passed through the electrodes comprising a cathodic pulse with a pulse duration of 0.12 milliseconds to 198 milliseconds and an anodic pulse with a pulse duration of 2 microseconds to 60 milliseconds (claim 1). These pulse durations yield a pulse train frequency of about 4 Hz to about 8200 Hz, and a frequency of 5 Hz to 4000 Hz is further claimed (claim 27). The plating bath is substantially devoid of at least a leveler or a brightener, and can also be devoid of both (claim 51). The cathodic duty cycle ranges from 60% to 99%, and the anodic duty cycle ranges from 1% to 40% (claims 31-36).

The method claimed in the copending application differs from the instant invention because the copending application does not disclose the aspect ratio of the recesses, as recited in claims 1 and 20-26.

Regarding claims 1 and 20-26, Barstad et al. disclose a method and plating solution for plating microvias, wherein "microvias with...aspect ratios of 5:1, 6:1, 7:1, 10:1 or greater, and even up to 15:1 or greater can be effectively plated...using plating solutions of the invention" (col. 10, lines 44-53). The plating bath does not require the use of levelers although their use is preferred (col. 3, lines 19-20). Anthony discloses a method for plating copper in through-holes using a pulse train of forward and reverse pulses, wherein the through-holes have a diameter "typically equal to or less than about 4 mils...[and a] thickness of the body which typically ranges from about 6 to 100 mils," which relates to an aspect ratio of up to 25:1 (col. 3, lines 54-61).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the method of the copending application to plate cavities or through-holes having an aspect ratio of greater than 20:1 because Barstad et al. and Anthony teach that similar methods and plating baths can be used to plate through-holes with aspect ratios of 15:1 or greater, and with aspect ratios up to 25:1.

This is a <u>provisional</u> obviousness-type double patenting rejection.

Response to Arguments

11. Applicant's arguments filed August 8, 2003, have been fully considered but they are not persuasive.

12. Regarding the rejection of claims 1-27 and 30 over Martin in view of Barstad, Applicant argues, "Based upon [the bath containing an unnamed PPR carrier and an unnamed PPR additive] and the description of the bath as being a 'standard bath' the

Office cannot conclude that Martin teaches or suggests the method of claim 1 where the bath is devoid of levelers or brighteners" (see page 6 of Applicant's response).

13. This argument is not persuasive because Martin does not require brighteners and levelers. In fact, in claim 4, Martin states, "[T]he electrolytic solution is an aqueous acid copper electrolyte, produced by combining sulfuric acid, copper sulfate, and chloride anions" (see US '398 col. 8, lines 5-10). Since the electrolytic solution used in Martin's claimed method comprises only sulfuric acid, copper sulfate, and chloride anions, it is the Examiner's position that the method of Martin teaches the bath recited in the instant invention, i.e., the bath does not require levelers or brighteners.

14. The use of plating baths devoid of levelers or brighteners is not uncommon in the art of electroplating copper. For example, Anthony (US '467) teaches a bath comprising copper sulfate, sulphuric acid, thiourea and molasses, where the thiourea and molasses act as brighteners, i.e., there are no levelers used. Additionally, Chen (US '181) teaches that "organic additives are not absolutely necessary to the plating solution", where the additives include levelers and brighteners.

15. Regarding the rejections of claims 1-20 and 27-29 over Dubin et al. in view of Martin, Applicant has argued, "Dubin does not remedy the basic defects in the teachings of Martin relative to levelers and brighteners" (see page 6 of Applicant's response). Since Dubin et al. teach that the electroplating composition comprises copper, at least one acid, at least one halogen ion and at least one additive (which is an accelerating agent, a suppressing agent or an accelerating-suppressing agent), Applicant's argument is not clear. If the bath of Dubin et al. only contains one additive,

it cannot contain both a brightener and a leveler. Furthermore, in that rejection, Martin was relied upon only for the teachings of the pulse cycles.

16. Regarding the rejection of claims 28 and 29 over Martin, Barstad or Anthony in view of Chen, Applicant has argued, "Chen addresses the formation of ultra-thin metal seed layers...[which] does not involve parallel considerations to plating high aspect ratio through holes and cavities" (see page 7 of Applicant's response). This argument is not persuasive because Chen teaches that "the organic additives may be used to produce desired film characteristics and provide better filling of the recessed structures on the wafer surface" (col. 7, lines 10-15). Since Chen teaches that the additives "may be used...to provide *better* filling of the recessed structures on the wafer surface" (emphasis added by Examiner), it is unclear why Applicant argues that the method of Chen cannot be used to plate through-holes or why one skilled in the art would fail to use the method of Chen when plating recesses on wafers.

Conclusion

17. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703) 305-0180. The examiner can normally be reached on Monday-Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

blm
August 19, 2003